NEMO

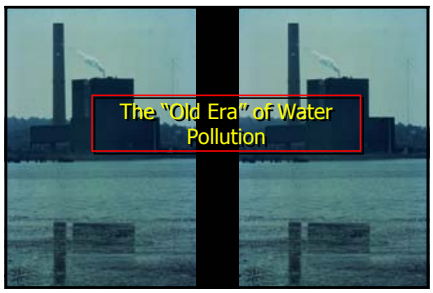
Nonpoint Education for Municipal Officials

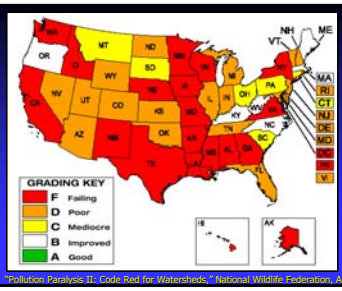
Linking Land Use to Water Quality

What We Are Going to Discuss...

- Introduction
  - Watershed Planning
  - Nonpoint Source Pollution
  - Land Use and Water Quality
- Gunstock River Subwatershed and Buildout Analysis
- Broad Recommendations
- Existing Land Use Regulations
- Project-Based Recommendations

Conclusions





Source: "Pollution Paralysis II: Code Red for Watersheds," National Wildlife Federation, April, 2000

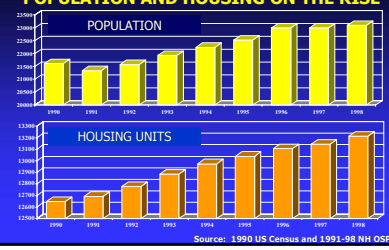
Major Sources of Nonpoint Source Pollution

- Lawns and Golf Courses
- Car Exhaust and other Air Pollution
- Man-made Waterways
- Road and Building Construction Sites
- Logging
- Roads and Parking Lots
- Agricultural Fields and Grazing Land

Local Land Use Decision Making: *Educational Challenges*

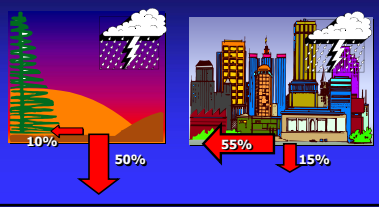
- Legal Mandates
- Full Plate
- High Turnover
- Complexity of Environmental Issues
- Tracking of Cumulative Impacts

GILFORD AND LACONIA POPULATION AND HOUSING ON THE RISE



Source: 1990 US Census and 1991-98 NH OSP

Development Impacts on the Water Cycle



The Effects of Urbanization

Development Impacts on Water Quality

Nutrients
Pathogens
Sediment
Toxic Contaminants
Debris
Thermal Stress

Increased development
Decreased water quality

The Pollutants in Polluted Runoff

Nutrients

Pathogens
Sediment
Toxic Contaminants
Debris
Thermal Stress

Nutrients **such as nitrogen and phosphorus are substances needed for growth, but elevated levels can cause a health hazard in drinking water *and* stimulate excessive aquatic plant growth, which can ultimately lower dissolved oxygen levels.**

Sources: animal waste, fertilizers, septic systems, auto emissions

The Pollutants in Polluted Runoff

Nutrients

Pathogens

Sediment
Toxic Contaminants
Debris
Thermal Stress

Pathogens **are disease-causing bacteria and viruses associated with the presence of fecal matter that cause shellfish bed and beach closures.**

Sources: failing septic systems, animal waste, marine sanitation devices

The Pollutants in Polluted Runoff

Nutrients
Pathogens

Sediment

Toxic Contaminants
Debris
Thermal Stress

Sediment **is eroded soil or sand which smothers aquatic habitat, carries pollutants, and reduces water clarity.**

Sources: road sand, construction sites, agricultural fields, disturbed areas

The Pollutants in Polluted Runoff

Nutrients
Pathogens
Sediment

Toxic Contaminants

Debris
Thermal Stress

Toxic contaminants **are compounds like heavy metals and pesticides that can threaten the health of both aquatic and human life, and are often resistant to breakdown.**

Sources: industrial, commercial, household and agricultural chemicals; auto emissions

The Pollutants in Polluted Runoff

Nutrients
Pathogens
Sediment
Toxic Contaminants

Debris

Thermal Stress

Debris **includes plastics and other trash that threaten aquatic life and detract from recreational and aesthetic values.**

Sources: illegal dumping, street litter, beach litter, boating waste

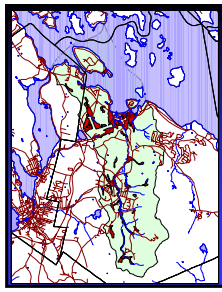
The Pollutants in Polluted Runoff

Nutrients
Pathogens
Sediment
Toxic Contaminants
Debris

Thermal Stress

Thermal stress **is an elevation in water temperature that can harm native species while helping non-native species to spread.**

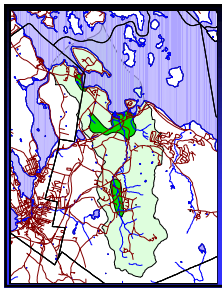
Sources: runoff from heat-absorbing impervious surfaces, removal of streamside vegetation, shallow water impoundments, decreased base flow



WETLANDS

Wetland Soils

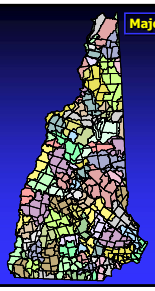
Source: Natural Resource Conservation Service soil survey field sheets, in progress



WATER RESOURCES

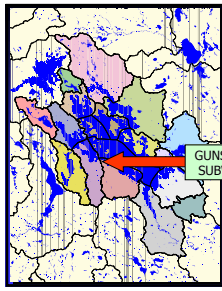
Aquifers
Surface Water

Source: USGS Open-File Report WRI 47-75, 1975



Major Watersheds in New Hampshire

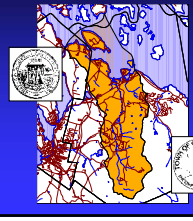
A WATERSHED IS AN AREA IN WHICH ALL DRAINAGE FLOWS TO A COMMON OUTLET.



Lake Winnipesaukee Drainage Subwatersheds

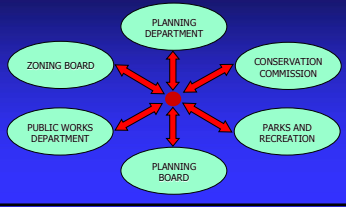
GUNSTOCK RIVER SUBWATERSHED

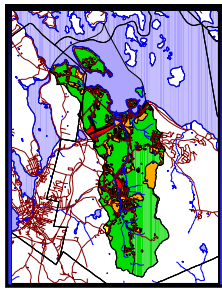
Watersheds Cross Boundaries: It takes communication!



- inter-regional cooperation
- inter-town cooperation

Watersheds Need Town-Wide Cooperation

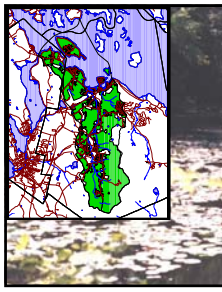




Land Cover Categories: Gunstock River Subwatershed

LEGEND

- Forested/Wetlands
- Open/Agricultural
- Residential
- Commercial/ Industrial
- Open Water



Forested and Wetlands

What to Look For:

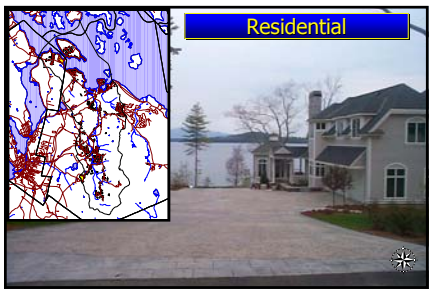
Polluted runoff from Forested & Wetland areas

Nutrients:
Pathogens: animal waste
Sediment: erosion from logging operations
Toxic:
Debris:
Thermal: removal of streamside vegetation

What to Look For:

Polluted runoff from Agriculture & Open Space areas

Nutrients: fertilizer from farms, parks, golf courses
Pathogens: domestic animal & wildlife waste
Sediment: erosion from agricultural fields
Toxic: pesticides from ag. lands & golf courses
Debris: litter & illegal dumping
Thermal: removal of streamside vegetation, shallow water impoundments



What to Look For:

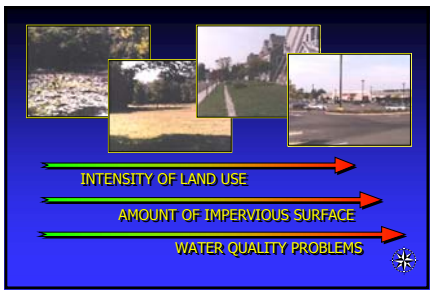
Polluted runoff from Residential areas

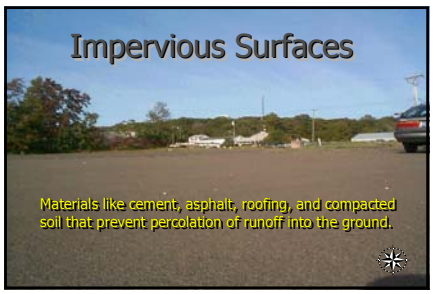
Nutrients: lawn fertilizers & septic system effluent
Pathogens: malfunctioning septic syst., pet waste
Sediment: construction, road sand, erosion from lawns & gardens
Toxic: household products, pesticides
Debris: litter & illegal dumping
Thermal: heated runoff, removal of streamside vegetation, impoundment's

What to Look For:

Polluted runoff from Commercial & Industrial areas

Nutrients: acid rain and car exhaust
Pathogens: malfunctioning or overloaded septic systems & lagoons
Sediment: construction, road sand, roadside erosion
Toxic: auto emissions, industrial pollutants
Debris: litter & illegal dumping
Thermal: heated runoff, removal of streamside vegetation, impoundment's

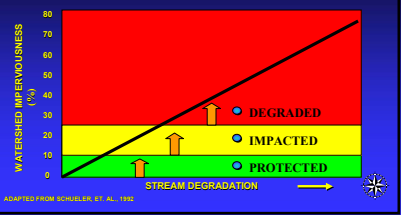




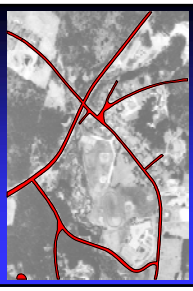
Impervious surfaces

- provide a surface for accumulation of pollutants
- provide an express route for pollutants to waterways
- prevent natural processing of pollutants in soil and plants
- inhibit recharge of groundwater

Waterway Health & Imperviousness



Impervious Surface Analysis,
Gilford Village
1993



Impervious Surface Analysis,
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- Roads - 85%

Impervious Surface Analysis,
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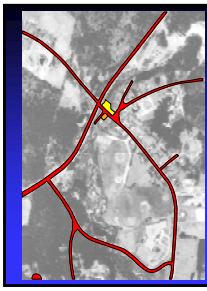
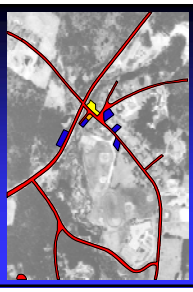
1993

- Roads - 85%
- Commercial - 60%



Impervious Surface Analysis,
Gilford Village
1993

- Roads - 85%
- Commercial - 60%
- Office/Town Structure - 60%



Impervious Surface Analysis,
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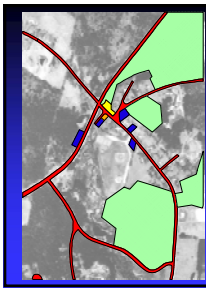
- Roads - 85%
- Commercial - 60%
- Office/Town Structure - 60%
- 0.25 Acre Residential - 38%



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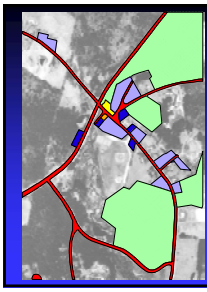
- 0.25 Acre Residential - 38%
- Civic - 30%



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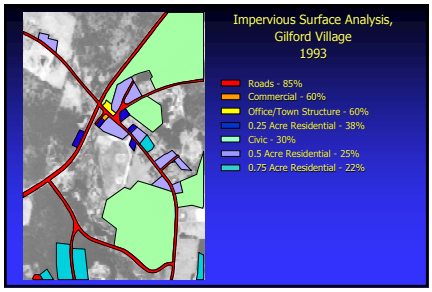
- 0.5 Acre Residential - 25%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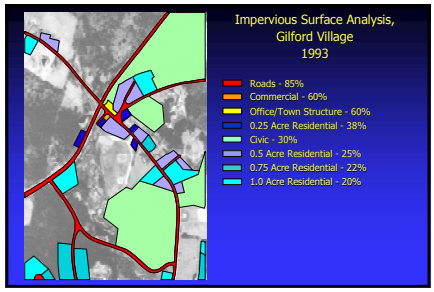
Civic - 30%
0.5 Acre Residential - 25%
0.75 Acre Residential - 22%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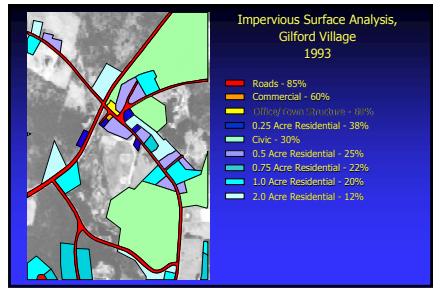
0.75 Acre Residential - 22%
1.0 Acre Residential - 20%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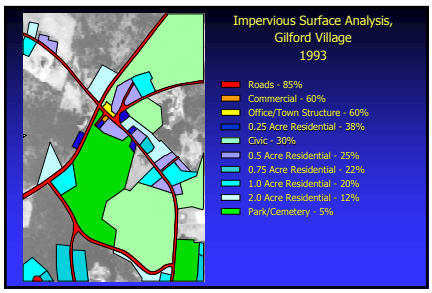
0.75 Acre Residential - 22%
1.0 Acre Residential - 20%
2.0 Acre Residential - 12%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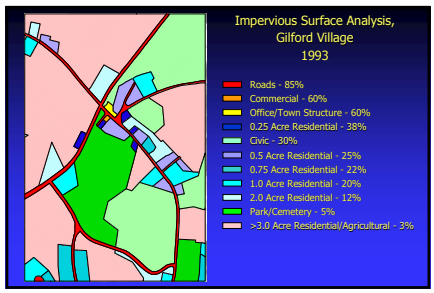
0.75 Acre Residential - 22%
1.0 Acre Residential - 20%
2.0 Acre Residential - 12%
Park/Cemetery - 5%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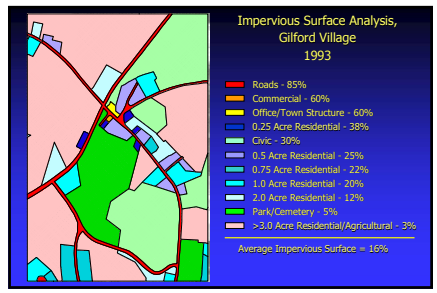
1.0 Acre Residential - 20%
2.0 Acre Residential - 12%
Park/Cemetery - 5%
>3.0 Acre Residential/Agricultural - 3%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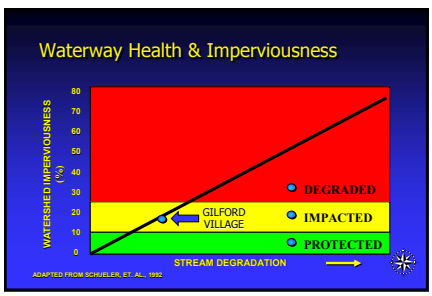
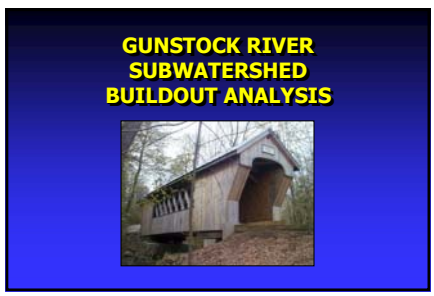
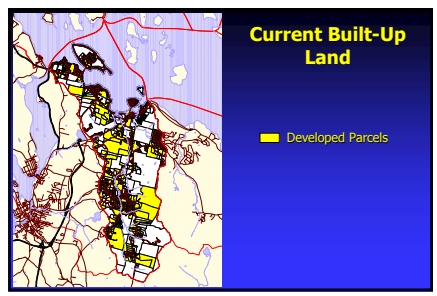
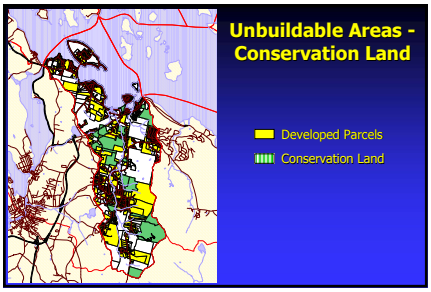
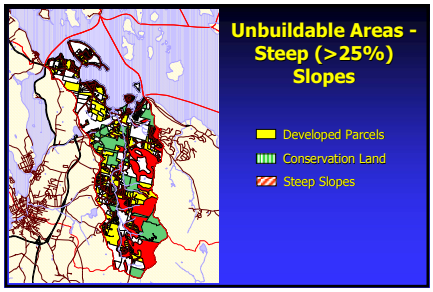
Park/Cemetery - 5%
>3.0 Acre Residential/Agricultural - 3%
Average Impervious Surface = 16%

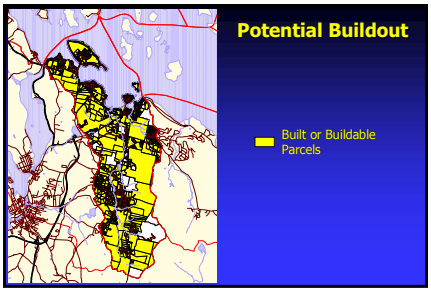

Waterway Health & Imperviousness
WATERSHED IMPERVIOUSNESS (%)
80
70
60
50
40
30
20
10
0
DEGRADED
GILFORD VILLAGE
IMPACTED
PROTECTED
STREAM DEGRADATION
ADAPTED FROM SCHUELER, ET. AL., 1992


GUNSTOCK RIVER
SUBWATERSHED
BUILDOUT ANALYSIS


Current Built-Up Land
Developed Parcels







Gunstock River Subwatershed Buildout Analysis Summary

Category	Acres	%
Currently Built	4420	45
Buildable	3846	39
Built and Buildable	8266	84
Total Land Area	9862	100

The *Three-tiered Strategy* for Coping with Polluted Runoff

1st: Natural Resource Based Planning

2nd: "Green" Site Design

3rd: Structural Best Management Practices (BMPs) & Remediation

Strategy for coping with polluted runoff

- ***1st:*** Natural Resource Based Planning

2nd: Site Design
3rd: Structural BMPs & Remediation

- inventory natural resources
- open space plan
- plan of conservation & development
- watershed plan
- change regulations

What About Developed Areas?

- It's STILL a planning issue!
- Every bit of GREEN helps
- Urban redevelopment is critical to reducing sprawl

Green is good!

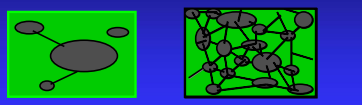
- For stormwater management
- For psychological health
- For aesthetics

Promote Mixed Use

- reduces auto traffic & sprawl
- promotes neighborhoods
- is redevelopment-friendly

The Broad View

Reducing Sprawl Means Concentrating Development in Urban & Village Centers



HIGH AMOUNT OF IMPERVIOUS SURFACE IN CENTRAL AREAS....

... BUT STILL LOWER OVERALL LEVELS THAN WITH SPRAWL

Strategy for coping with polluted runoff

1st: Natural Resource Based Planning

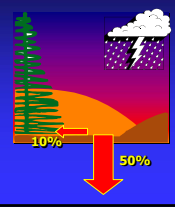
2nd: Site Design

3rd: Structural BMPs & Remediation

Encourage stormwater management plans that:

- put development in context of local and regional watersheds
- retain the natural landscape
- reduce impervious surfaces
- emphasize on-site drainage of stormwater
- encourage riparian buffers
- require proper septic system placement, design, and maintenance

Design Principles



Retain, Restore the Natural Landscape

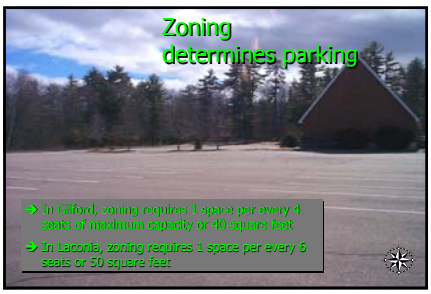
...by Promoting Infiltration

Retain the Natural Landscape

Zoning determines parking

- Zoning often requires almost twice the number of stalls actually used in peak periods

Zoning determines parking



- In Gilford, zoning requires 1 space per every 4 seats of maximum capacity or 40 square feet
- In Laconia, zoning requires 1 space per every 6 seats or 50 square feet

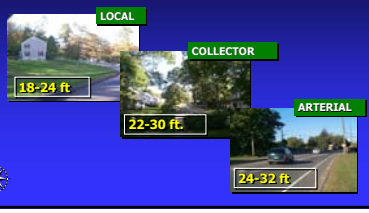
Alternatives to Pavement

Road Form should follow Function

- wide
- straight
- curbed
- barren

- narrow
- winding
- shaded

Pavement Width varies with function



Engineered Swales

- Promote infiltration
- Most effective at sediment removal
- Open, above-ground systems are easier to maintain & troubleshoot
- Installation costs are favorable compared to piped drainage

Driveways

Are we we overdoing it?

Driveway Tips

- design shorter and narrower drives
- design wide turnaround areas only where needed

Driveway Tips

- design drives to follow contours & drain to pervious areas
- use pervious alternatives

Sidewalk Tips

- sidewalks only where they make sense
- one side of the street only
- separate sidewalks from road & drainage system by vegetated strips
- consider pervious alternatives

Strategy for coping with polluted runoff

1st: Natural Resource Based Planning
2nd: Site Design

- ***3rd:*** Structural BMPs & Remediation
  - encourage most natural & vegetated stormwater controls
  - ensure maintenance of roads, lots, catch basins, and BMPs
  - support restoration where effective
  - encourage redevelopment and infilling to avoid further sprawl

Research increasingly shows the benefits of stormwater systems which are:

- OPEN VS. CLOSED
- VEGETATED VS. MECHANICAL
- INFILTRATION VS. RETENTION

Vegetated Buffers

- BMPs should recognize the importance of riparian and wetland buffers
- buffers are the first line of defense against the impacts of impervious surfaces
- natural vegetation buffers are especially critical in urban areas

Encourage Maintenance of BMPs

- Proper Road Salting and Snow Dumping
- Road Sand Removal
- Septic System Maintenance
- Erosion Control during and after Construction
- Proper Herbicide/Pesticide Application
- Erosion Control during Timber Harvesting Operations
- Stormwater Management in Urban and Semi-Urban Environments
- Road Maintenance

Education is a BMP

Support educational programs

- schools
- residents
- town staff & crews
- town officials

Support special activities

- stormdrain stenciling
- clean-up days
- other resource protection events (e.g., BCCD)

So Why Do This?

The good ol' *status quo*...

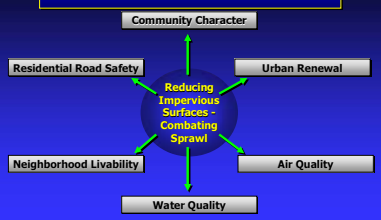
Is it really working all that well?

So Why Do This?

It's More Than Quantity of Pavement...

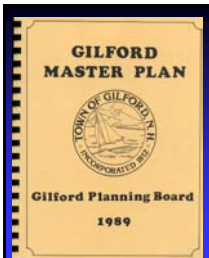
...it's Quality of Life!

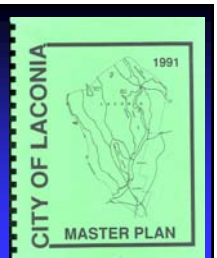
It's Not Just About Water...



IT'S UP TO YOU...

IT'S YOUR TOWN!





GILFORD MASTER PLAN

General Goals (pg. 111)

"Gilford desires to grow within the capabilities of the town's resources in a manner that is in harmony with the natural environment and municipal services. The town desires to avoid sudden spurts of rapid residential growth and minimize the impacts of all growth on the town's rural character."

Objectives:

1. Gilford desires to maintain its rural character with its combination of open fields, woods, scenic views, mountains and shorefronts.

2. Gilford desires to protect areas of unusual natural, scenic, or historic value from inappropriate development.

3. Gilford wishes to protect its shorefront areas from incompatible development.

LACONIA MASTER PLAN

GOAL #4 (pg. 2-14)

"Protect and preserve environmentally sensitive areas of importance within Laconia and the region."

OBJECTIVES

B. Encourage a level of development that will not have negative affects on the natural features that make the City a desirable place to live.

C. Revise and expand the City's land use regulations in order to better protect natural resources.

"The Town may want to review its current standards to see if additional preventative measures against stormwater runoff are needed."

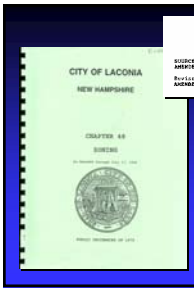
--- 1989 Master Plan

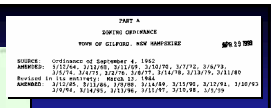
MASTER PLAN RECOMMENDATIONS

1. Make water quality and the reduction of NPS pollution a GOAL.

2. Revise municipal land use regulations to reflect a commitment to improved water quality.

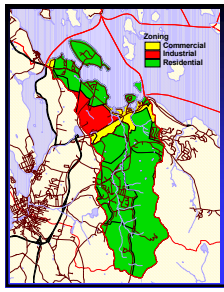
3. Make water resource education a priority.





Master Plan Implementation

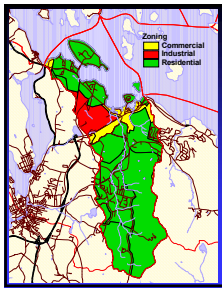
- Lot standards
- Districts
- Parking requirements
- Special exceptions



ZONING

LOT STANDARDS

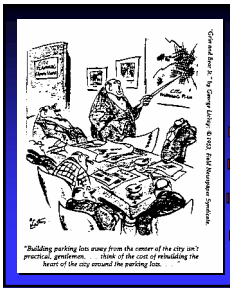
- Coverage (%)
- Setback Requirements
- Buffering Requirements



ZONING

DISTRICTS

- Island and Shore Frontage Districts
- Resort/Commercial Districts
- Town-wide Standards



ZONING

PARKING

- Quantity
- Access
- Buffering
- Stormwater Management

ZONING

SPECIAL EXCEPTIONS

- Parking
- Buffering
- Drainage

Subdivision and Site Plan Review Regulations

- General - Relation to Master Plan and Water Resource Protection Plans
- Landscaping
- Drainage
- Sediment and Erosion Control Plan

GENERAL

- Clearly Defined Planning Board Policy
- Board Member Transition

LANDSCAPING

- Include Water Protection as a Goal

> Landscaping shall provide privacy and screening for adjacent land uses with visual, noise, energy conservation, and air quality factors considered.
>
> --- Gilford, NH Site Plan Review Regulations

> The process of development with its alteration of the natural topography and creation of impervious cover can have a negative effect on the ecological balance of an area by causing increases in air temperature and by accelerating the processes of runoff, erosion and sedimentation.
>
> --- Durham, NH Landscape Ordinance

DRAINAGE

- Fundamental
- Natural vs. Constructed
- Maintenance and Monitoring
- Waivers

SEDIMENT AND EROSION CONTROL PLAN

- Applicability

> Activity involving five (5) or more acres or exposing ten thousand (10,000) or more square feet of soil.
>
> --- Gilford, NH Site Plan Review Regulations

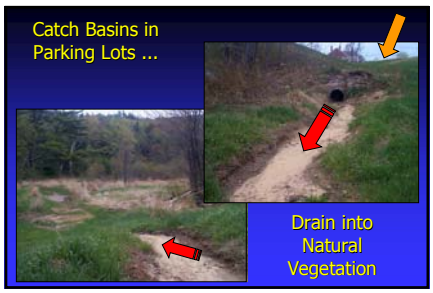
> Initiate any land clearing, land grading, earth moving, or development activities in excess of one (1) acre...
>
> --- Wayne County Soil and Water Conservation District

> ... No person may engage in any land-disturbing activity until an erosion and sediment control plan for the land-disturbing activity has been submitted ...[and approved]
>
> --- Lancaster County Erosion and Sediment Control Ordinance

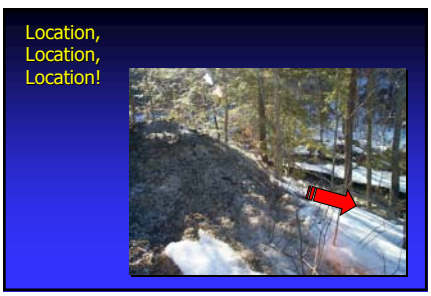
Catch Basins on Roads and in Parking Lots ...

Drain Directly into the River


Catch Basins in
Parking Lots ...
Drain Directly
into the Lake


Catch Basins in
Parking Lots ...
Drain into
Natural
Vegetation

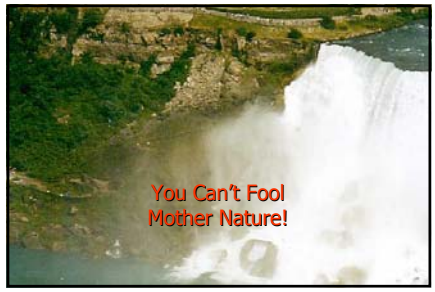

Salt and Snow
Dumping and Storage


Location,
Location,
Location!


Push Snow
Here!


Town Garage
Runoff and
Erosion

Why drain a pervious surface?



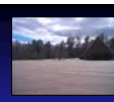
GENERAL RECOMMENDATIONS

1. Encourage BMPs in Site Plan Review and Subdivision Control

2. Reduce Roadway Width

3. Reduce Driveway Width and Length

4. Reduce Size Requirements and Amount of Impervious Surface in Parking Areas



5. Continue to Encourage Using Pervious Surfaces in Parking Lots and Driveways

6. Reduce the Amount of Impervious Surfaces, Especially Contiguous Ones

7. Encourage Vegetated Buffering Around Impervious Surfaces and Water Bodies

8. Encourage Natural Infiltration Stormwater Management Systems above Constructed

9. Prohibit the Direct Discharge of Untreated Stormwater Runoff into Water Bodies

10. Maintain and Enhance Proper Snow and Salt Storage and Dumping Policies